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GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF FISHERIES

THE DEVELOPMENT OF THE NEWFOUNDLAND EEL FISHERY 1982

Development Branch Report No. 30

JUNE, 1983

THE DEVELOPMENT OF THE NEWFOUNDLAND EEL FISHERY 1982

by

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Department of Fisheries

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INTRODUCTION

The American eel, Anguilla rostrata (Lesueur) is commonly found in all river systems throughout Newfoundland and ranges northward to Lake Melville in Labrador, however, abundance declines with northward movement.

The eel has the ability to adapt to wide range of conditions and is found in a wide range of habitats; this is exemplified in its unusual life history.

A catadromous species, the young eels are born in salt water and migrate into fresh water systems as juveniles, remaining there for approximately 12 years until sexual maturity. They then migrate back to the sea to spawn and die, with the young being passively returned to rivers by ocean currents.

The eel fishery in Newfoundland is presently considered underdeveloped, with previous attempts at establishing local fisheries resulting in limited success on a short-term basis. The primary reason for this failure has been the depletion of local eel populations due to overfishing. Past experience in overexploitation of the "yellow" eel resource using baited eel pots was evidence that a more biologically sound harvesting of the eel resource was needed.

During 1979, the Provincial Department of Fisheries included eels in its underutilized species development program and initiated efforts to assist in the harvesting of this resource. The early forms of assistance involved the promotion

of the baited pot fishery concentrating on sexually immature "yellow" eels. However, the detrimental effects on eel populations were soon realized and the fishing method was shifted fo a fyke net fishery harvesting predominately "silver eels". The "silver" eel is sexually mature and migrates from the fresh water system to spawn in the Sargasso Sea.

This migration occurs in the fall of each year, usually September and October. During 1982, a fishery based on this migration was undertaken in some rivers in Notre Dame Bay and Bonavista Bay. Approximately 14,515kgs. of eels were taken in a 3-week period.

A total of 36,722 kgs. (80,959 lbs.) of eels were taken in 1982. The areas fished and landings for each statistical area are given in Figure One.

This report outlines 1982 development activities; reviews the Newfoundland eel fishery in relation to other Provinces; and, provides recommendations for future development of the eel resource.

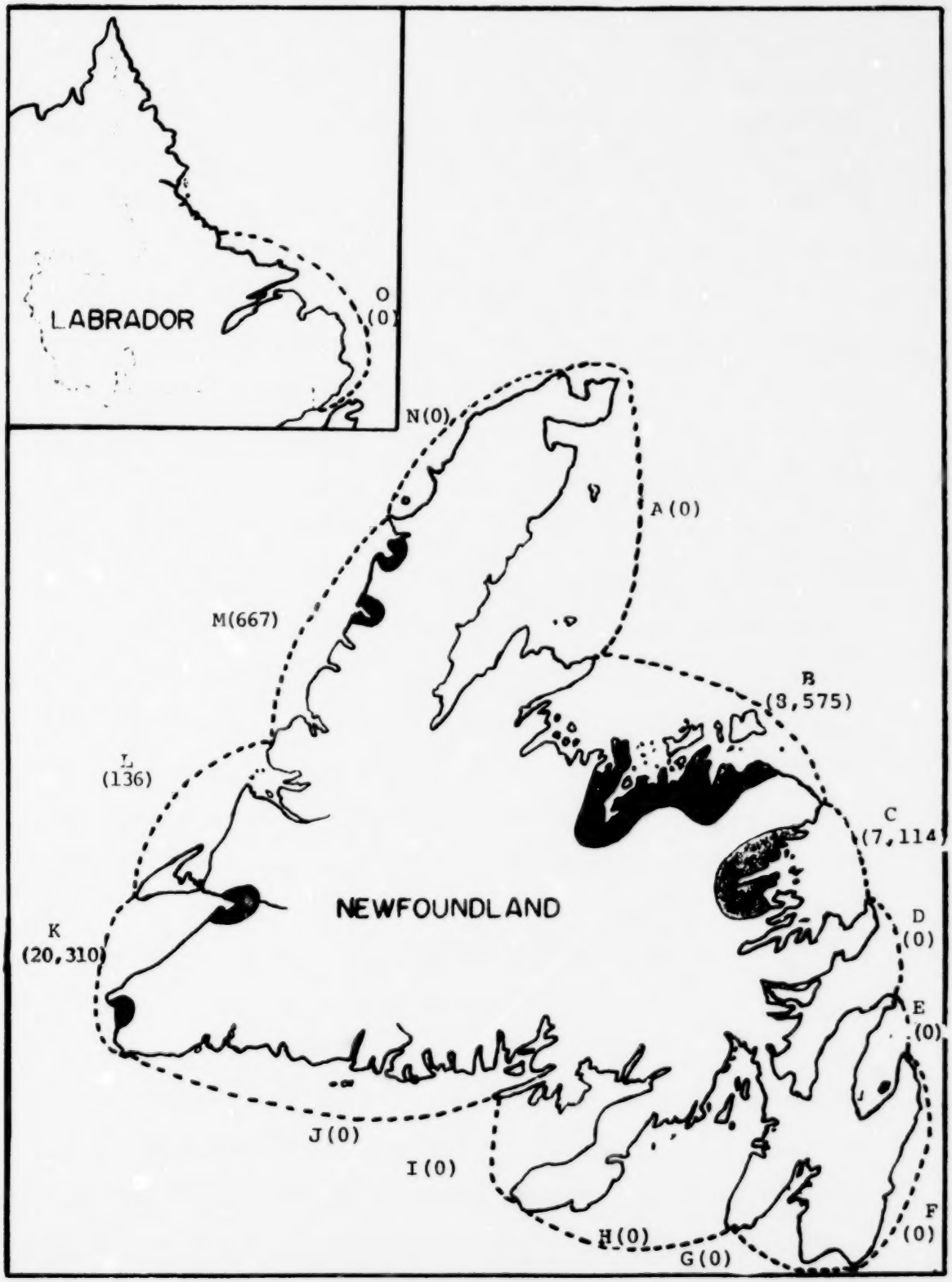

Figure 1: Areas fished during 1982 with landings for each area (Kgs.).

BIOLOGY OF THE AMERICAN EEL

Anguilla rostrata commonly called the American eel is easily distinguishable from other fish by its serpentine body, single gill openings and a continuous dorsal, anal and caudal fin. The eel is extremely hardy and able to adapt to a variety of habitats ranging from ocean and inland waters and there have been reports of their moving onto land to cross dams or roads. This ability to adapt is seen in the eels unusual life history. Eels spawn in the Sargasso Sea in mid-winter. Between 15-20 millions eggs per female are believed fertilized in 400 metres of water and develop into leptocephali larva which live in the surface waters and are carried passively by currents towards the coast of North America (Figure 2). The larva undergo a transformation as they approach the coast and become the transparent "glass" eel which resembles the adult (Figure 3). Upon reaching the coast they develop pigments and become miniature eels known as elvers, which are 5-75mm (2-3 inches) long. The elvers accumulate around the estuaries and begin their upstream migration in May or June. The number of elvers and the time of upstream migration varies with localities (Eales, 1968). Elvers are able to colonize rivers and streams which are blocked with dams and falls. However, the greater the distance and number of barriers between the ocean and the lakes, the less likely the chance of colonization (Smith

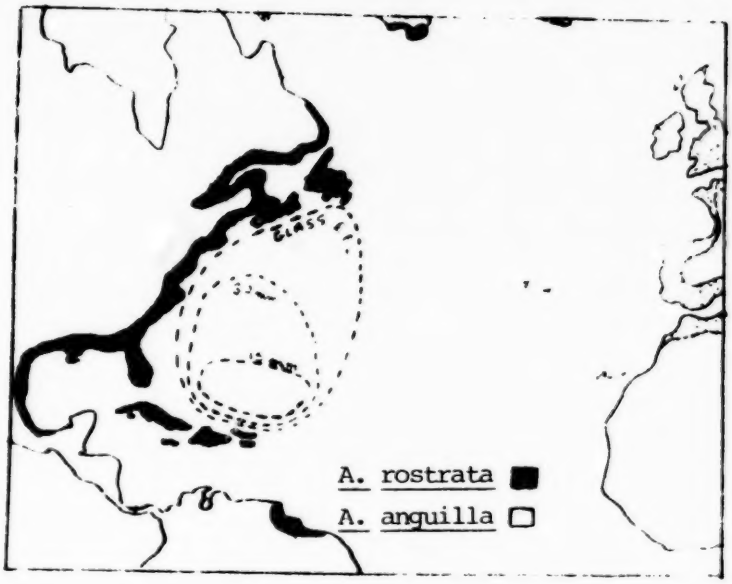

Figure 2: Distribution and spawning area of Anguilla rostrata is illustrated along with the distribution of Anguilla anguilla. The development of the larval stages is shown based on information from Schmidt, 1922 and Vladykov, 1964.

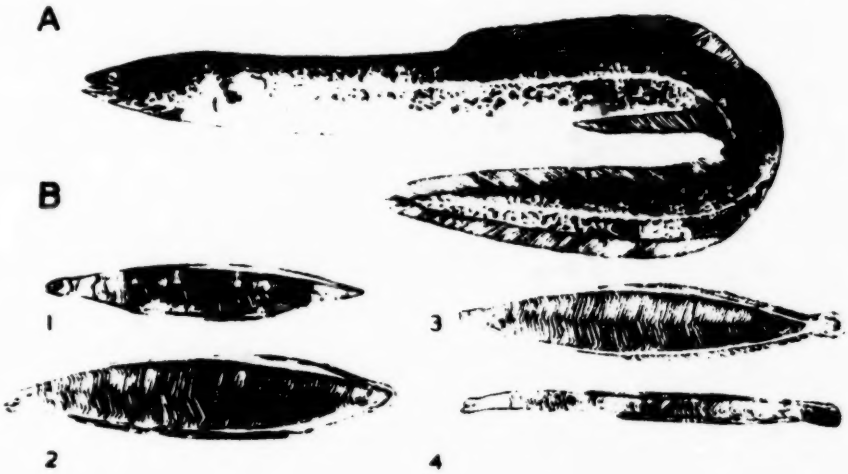

Figure 3: Drawings of (A) yellow eel and (B) leptocephali (drawn from Bigelow and Schroeder, 1953). (1) Leptocephalus (49mm); (2) Leptocephalus (55mm); (3) Leptocephauls (58mm); (4) Transformation stage (61mm) (from Eales, J.G., 1968. "The Eel Fisheries of Eastern Canada" F.R.B.C. Bulletin 166. p.p. 79).

and Saunders, 1955). It is generally believed that the male eel remains near the estuary and the female migrates into the fresh water systems. Since the productivity of fresh water systems is low, eels often migrate to salt water in the spring to feed and move back into the fresh water systems in the fall of each year to hibernate in the mud during the winter.

The eel reaches maturity after approximately 12 years and transforms from its "yellow" eel stage into a "silver" eel. This transformation can be seen by the marked colour change and increase in eye diameter. Furthermore, internal changes occur, the fat content increases, the digestive tract degenerates, mucus production is reduced, the gonads develop and osmoregulatory capability changes (D'Ancona, 1960).

The "silver" eels migrate to the ocean in autumn. In Newfoundland the run was found to occur during the first heavy rainfall following the full moon in September. The migration of "silver" eel is strongly affected by environmental conditions, the main one being light intensity (Eales, 1968) as bright lights have been used to prevent migration of European "silver" eels. This may account for the runs on dark rainy nights, which were recorded during 1982 in Central and Eastern Newfoundland.

Once the "silver" eel reaches the salt water they travel to the Sargasso Sea. No adult eels have ever been taken in the Sargasso region, despite the fact that this area is abundant with leptocephali larva indicating that spawning occurs there. The adult "silver" eel dies after spawning and the young eels are returned, passively, to the North American coast by ocean currents.

Since the young eels do not return to the same river where their parents lived and the "silver" eel dies after spawning, it is possible to remove all the "silver" eels from a river system without affecting the population or return of elvers in subsequent years. Thus the method of fishing for "silver" eels is biologically sound and will produce consistent yearly landings provided elver colonization was sufficient in previous years.

THE CANADIAN EEL FISHERY

The global eel industry is a large business with trading in the vicinity of 1 billion dollars per year. The value of eels to Canadian fishermen in 1980 was $1,670,000.00 of which Newfoundland's portion was $90,000.00.

The eel fisheries of Ontario, Quebec, New Brunswick and Prince Edward Island yielded over 100,000kgs. (220,000) lbs. annually over the 1974-80 period (Figure 4). The Nova Scotian eel fishery is considered underdeveloped with 25 - 50,000kgs. landed annually.

The Maritimes' eel fishery is pursued by a large number of fishermen in conjunction with other fisheries. The predominant fishing method is fyke nets or river weirs with the latter being common in Nova Scotia.

Quebec has the largest eel fishery in Canada producing approximately fifty percent of the total Canadian eel landings. The fishery is sub-divided into an estuary fishery and an inland fishery with the former accounting for 75 percent of total landings. The estuary fishery takes place on the shores of the St. Lawrence River using fixed gear (river weirs) while the inland fishery uses fyke nets. Prices received for eels in Quebec are the highest in the country. In 1979 for example, "silver" eels were valued at $4.14 per kilogram ($1.87 per lb) and "yellow" eels were valued slightly lower at $3.35 per kilogram ($1.52 per lb.). In 1978 eels

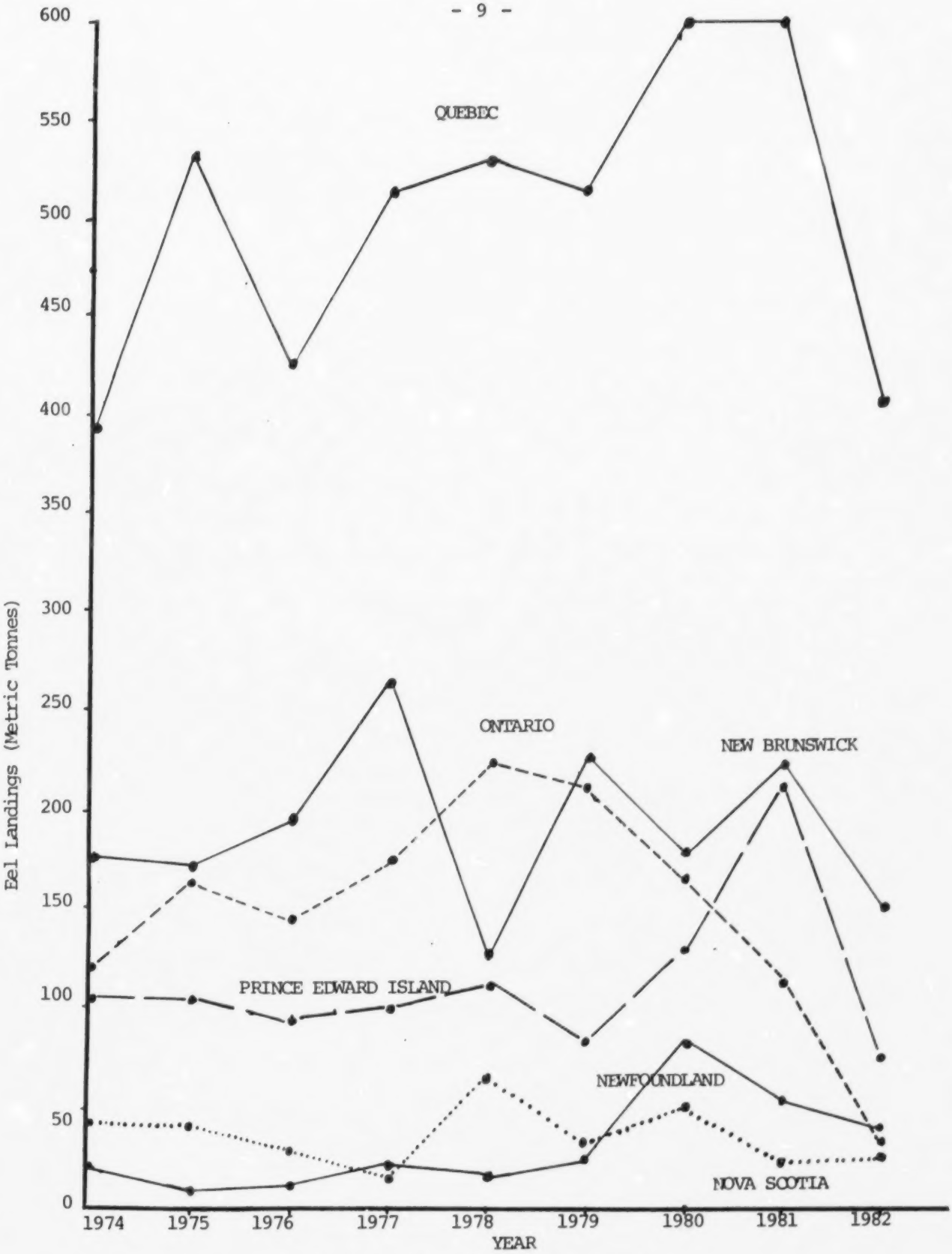

Figure 4: Provincial Landings of Eels from 1974-1982.

ranked fourth in value among commercially exploited species in Quebec exceeded only by cod, lobster and shrimp. (Ontario Ministry of Natural Resources 1982).

In Ontario baited hooks are used for the harvesting of eels. During the past 3 years the Ontario eel fishery has declined due to problems with contaminants and in 1982 the eel fishery was closed due to high levels of Mirex*, which were above European standards.

Newfoundland's eel landings have ranged from 12 metric tons to 82 metric tons over the last 5 years. The total catch for 1982 was 36 metric tons (See Figure 5). The 1982 fishery was restricted by lack of buyers in areas where commercial quantities of eels are known to exist. Only 4 statistical areas recorded catches during the past year compared with 12 areas during 1981.

Reduced eel landings in other Provinces have created more stable market conditions which should generate greater stability within the local industry over the longer term. In 1982, there were four eel buyers operating in Newfoundland (Table 1).

*Mirex is the brand name for a pesticide and flame retardant which was used in the Great Lakes region. It wasbanned in December of 1978.

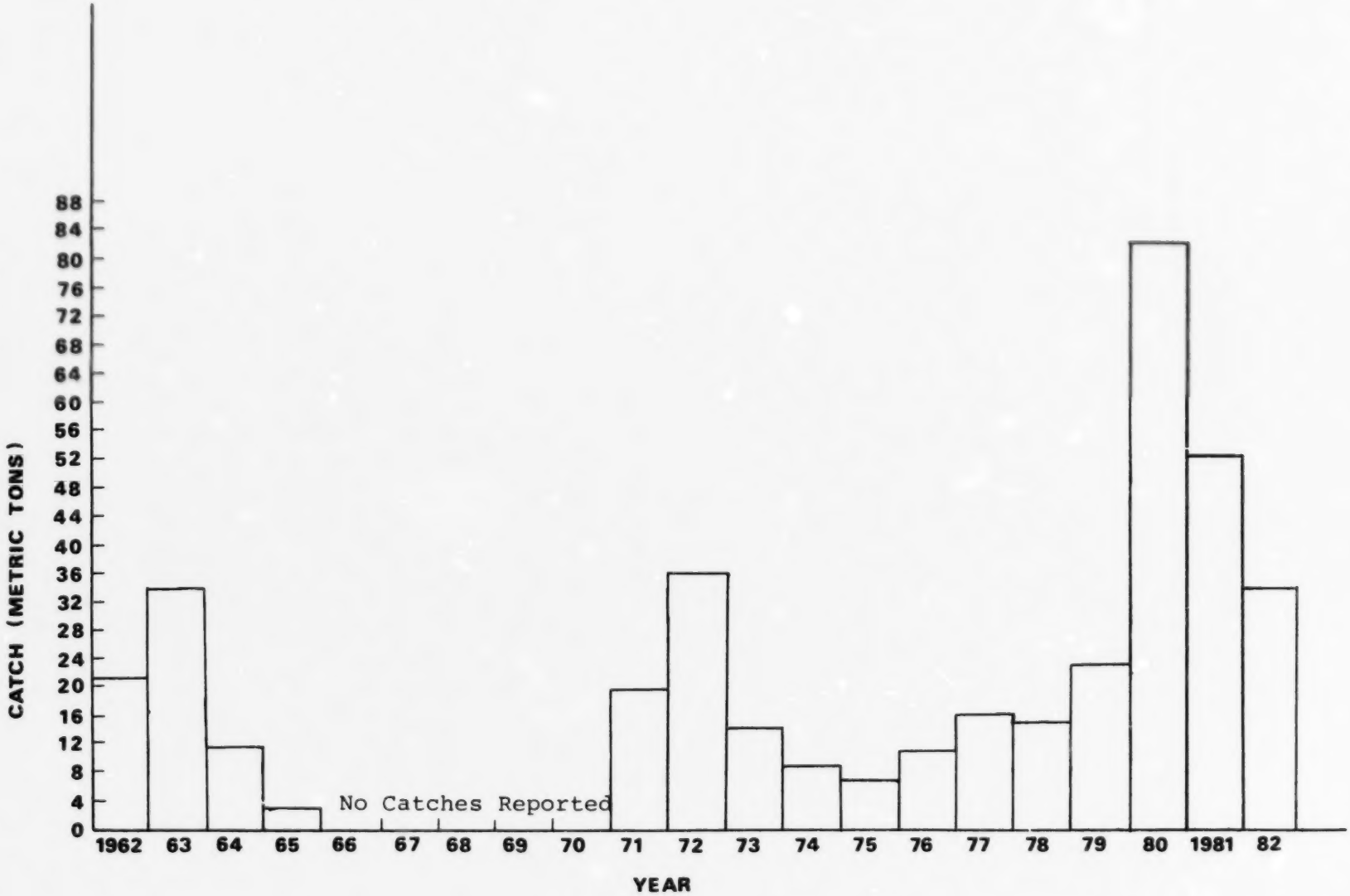

Figure 5: The Newfoundland American Eel (Anguilla rostrata) catches in metric tons for the period 1962 to 1982.

Table 1: Newfoundland eel buyers 1982

Plant	Location	Telephone	Type	Area Covered
A.W. Moores Ltd.	Codroy	955-2550	Live & Frozen "yellow" eels	Codroy-Bay St. George & River of Pond
Bay St. George Seafoods Ltd.	Stephenville	643-4961	Live "yellow" eels	Bay St. George
Trans-Atlantic Seafoods	Gander	651-4111	Live "silver" eels	Gander
Ichthus Sea Products Ltd.	Glovertown	533-6092	Frozen "silver" eels	Notre Dame Bay & Bonavista Bay

DEVELOPMENT ACTIVITIES

Technical Assistance - Bonavista Bay and Notre Dame Bay

During 1982, thirteen fishermen (Table 2) were supplied with 2-4 fyke nets each and given technical assistance in the setting and maintenance of the gear. The fyke nets were constructed by Department personnel during the winter of 1982 and by an experienced eel fisherman from Notre Dame Bay, whom the Department employed for four months during the summer and fall of 1982. The nets were a modified version of a Dutch fyke net, (See Appendix A). The hoops were replaced by a metal frame box to increase stability and the number of funnels was reduced from five to one to prevent blockage due to accumulation of debris, such as leaves and twigs.

The nets were distributed to interested fishermen in Notre Dame Bay and Bonavista Bay during the first weeks of August and were set on August 15th., when the season opened. Catches for each river were recorded nightly and are presented under the section dealing with results.

In addition to the nets supplied to fishermen a weir was constructed of 4 foot sections of wire screen with a 1 inch by ½ inch mesh size. Materials and assistance were supplied to an eel fisherman in Glovertown and the weir was put in place on Maccles Brook, a tributary of the Terra Nova River, on August 15th. Catches were recorded for each day and the ability of the weir to fish during flood periods was demonstrated in October, when high water levels made fishing fyke nets impossible.

Table 2: List of eel fishermen and rivers fished.

	Name	River	1982 Landings (kgs.)
1.	Mr. Sandy Feltham, Glovertown,	Terra Nova River, (Maccles Brook) Gambo River (Mint Brook) Square Pond Brook	1,545
2.	Mr. Murray Collins, Hare Bay, B.Bay	Middle Brook Traverse Brook	1,773
3.	Mr. Clyde Glover, Trinity, Nfld.	South West Brook Trinity Brook & 1st. Pond River	864
4.	Mr. Edwin Hunt, Indian Bay, B.B.	Indian Bay River (Salmon River) Northwest Brook	1,012
5.	Mr. Jack Winters, Valleyfield, B.B.	South West Brook	910
6.	Mr. Pinsent, Ragged Harbour	Ragged Harbour River	1,139
7.	Mr. Ralph Bursey, Davidsville	Mouth of Gander River with pots & several small streams	455
8.	Mr. Harold Hart, Stoneville,	Horwood River	1,910
9.	Mr. Harry Harnett, Campbellton, N.D.B.	Loon Bay Brook Campbellton Brook	3,318
10.	Mr. Maurice Tetford, Lawrencton	Browns Hole Brook other small brooks	-
11.	Mr. Ben Dyke, Norris Arm	Eel Brook Bottom Brook and Norris Arm Brook	-
12.	Mr. Terry Wells, Botwood,	Peters River Northwest River	789
13.	Mr. Wayne Thompson, Point Leamington	Western Arm River N.W. Arm River	580

The total landings for the area of development during 1982 was 14,515kgs. (32,000 lbs.) of which 94 percent was taken in fyke nets. Furtheremore, 90-95 percent of the eels taken by fyke nets were "silver", sexually mature eels.

Eel Landings During 1982

The season for fishing fyke nets commenced on August 15th. and several fishermen set their nets on that date. In Central and Eastern Newfoundland 20-25 lbs. per night were taken during the period August 15 - Sept. 7 despite low water levels. The first run of eels occurred on September 8th. followed by another run on Sept. 10 and Sept. 16 with good catches throughout this period. Catches then declined as rising water levels caused many fishermen to take up their fyke nets. The largest run of eels occurred on October during heavy rain. Only 2 fishermen were able to fish during this flood period and both recorded catches of nearly 1,000 lbs. before high water forced them to abandon fishing. Consequently, the main run of "silver" eels in the majority of rivers was not taken due to the inaiblity to fish during flood periods.

In order to effectively fish large rivers during high water periods, associated with the "silver" eel run, a fishing method other than fyke nets is required. The river

weir is a proven method for fishing "silver" eels in Quebec and the Maritime Provinces and the feasibility of using weirs in Newfoundland rivers was tested during 1982. A wire mesh weir was installed on Maccles Brook during August and fished effectively until it was removed on November 7. The only problem occurred during early October when a large piece of debris knocked out one section. This was later replaced on October 9th.

The Bay St. George region has had a successful eel fishery for nearly 10 years. The fishery is based on the "yellow" eels which migrate from the estuaries into fresh water systems to "mud in" (hibernate) for the winter months. Nets are set in the shallow estuaries facing the ocean and the eels are taken on the incoming tides. This fishery is conducted in conjunction with a pot fishery which is pursued in the spring and summer.

The net fishery began on August 15, however, the majority of eels were taken in late September and October during the first "frost". Total landings for this area for 1982 amounted to 19,893 kgs.(43,865 lbs.).

This method of fishing is only suitable in areas where shallow estuaries exist and would not be practical in the majority of rivers in other regions of the Province.

Assistance to Bay D'Espoir Development Association

During 1981, the Bay D'Espoir Development Association received funding from the Local Employment Assistance Program (LEAP) to assess the potential of the area for an eel fishery and to construct a facility for holding eels over winter for marketing at a later date.

Representatives from the Provincial Department of Fisheries visited the area to assist in the selection of a site and provided gear for the experimental fishery. A project consultant estimated a total obtainable yield of 62,500 kgs. of eels of which 20,000 kgs. could be harvested annually (Button, 1981).

After the potential had been estimated the Development Association directed its efforts to the procurement of fishing gear. In 1982, a grant was obtained from the Canadian Community Development Program to construct eel pots and fyke nets to be utilized in the commercial fishery during 1983. The Department assisted in ordering of materials for the project and provided technical assistance during the construction phase of the project, which commenced in February, 1983.

Relationship of Eel Landings to Watershed Area

The catches of eels were recorded for 7 rivers in Central and Eastern Newfoundland, and the watershed area obtained from "Catalogue of Rivers in Insular Newfoundland" Volume D.

The graph illustrates the relationship between eel catches and watershed area. The pounds per square kilometer ranged from 18.3 to 2.9 with an average of 8.4 and a correlation coefficent of

Table 3: Relationship of eel catches to watershed area.

River	Area of Basin-Km^2	Lbs. Landed	Lbs. per Km^2
Maccles River	300	1146	3.8
Traverse Brook	404	2588	6.4
Middle Brook	275	1852	6.7
Mint Brook	300	883	2.9
Ragged Harbour River	440	2505	5.7
Campbellton & Loon Bay River	400	7300	18.3
Horwood River	365	5000	13.7
Total:	2534	21,274	8.4

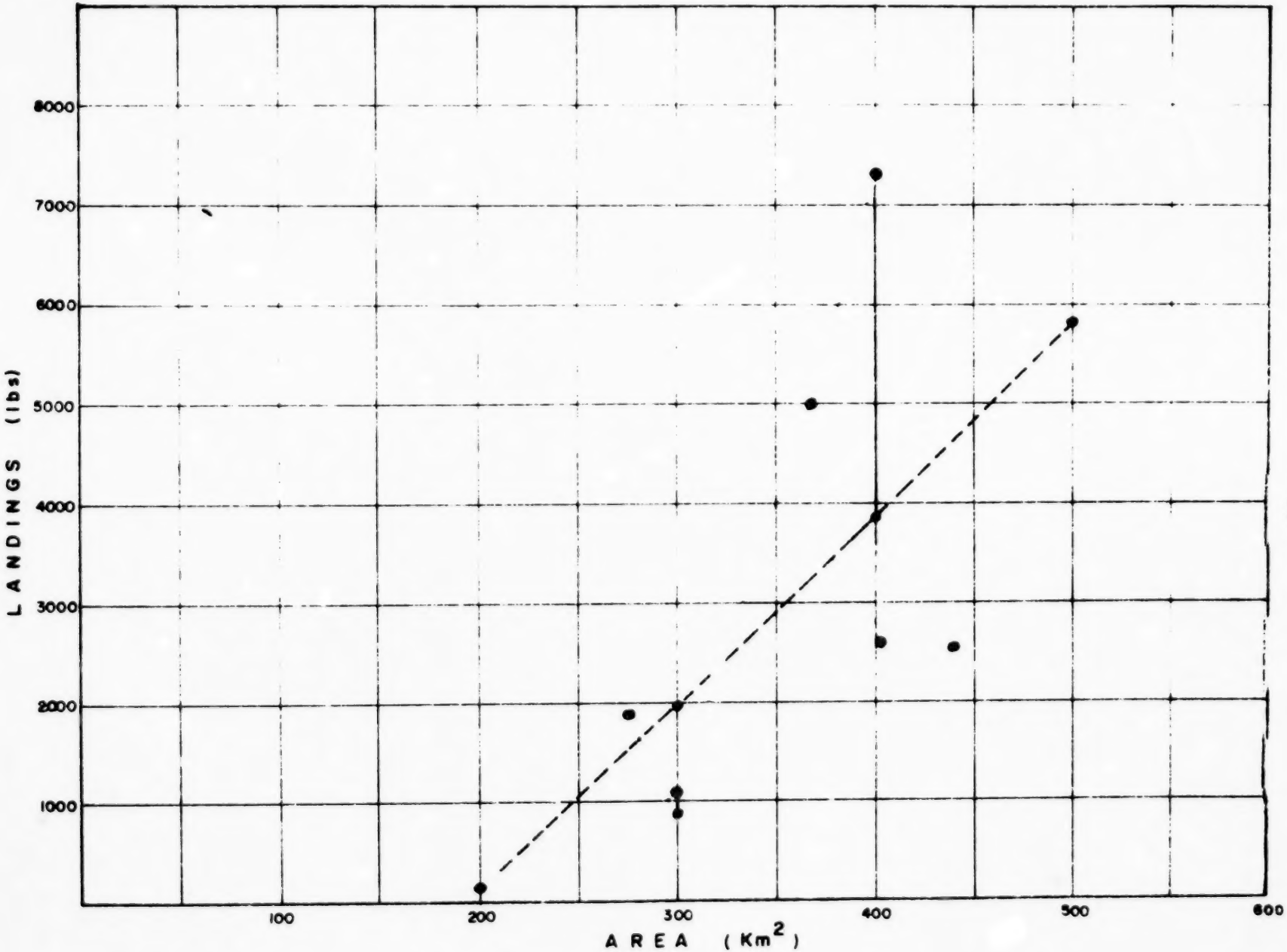

Figure 6: Eel landings in relation to watershed area.

r= .52. The inexperience of some fishermen caused decreases in landings because of improperly set nets, thus the landings for some rivers should have been higher.

The productivity of Newfoundland freshwater systems is low and the limiting factor in the growth and abundance of eels is probably food supply. However, the productivity of certain lakes and rivers may be greater than others. The inadequate food supply is the main reason for migrations of feeding "yellow" eels from freshwater to the more productive estuaries in the spring of the year.

The graph indicates that freshwater systems less than 200 km^2 do not have eel populations, and there are no fisheries in the smaller river systems. Eels are still found in small freshwater systems but not usually in commercial quantites.

Based on the figures obtained, the potential eel landings can be estimated for any river system if the watershed area is known. For instance, the Gambo River has a watershed of 1152kms^2, thus the estimated yield would be 4,398 kgs. (9,677 lbs.)

It should be noted that the above figure is an estimate, and landings will vary depending upon several factors such as elver colonization in previous years and the ability of the fishermen to fish a large river during flood periods.

Based on these figures, the total resource of eels for insular Newfoundland (area 111,369 kms^2) would be about 425,000 kgs. Since there are regions where elver colonization is restricted and areas where eel populations are already overfished, this may be an overestimate. The real resource potential could be in the range of 200-300,000 kgs.

Environmental Factors Affecting Silver Eel Migrations

The intensity of movement of "silver" eels from fresh water systems is influenced by a number of environmental factors. The most commonly documented are: the phase of the moon, prevailing weather conditions (especially rainfall) and the strength and flow of the river. These factors were observed in relation to eel landings in the Notre Dame Bay and Bonavista Bay areas in order to determine if eel migrations could be predicted in the future.

The migration of eels in fresh water occurs almost entirely between sunset and midnight with very few eels taken between midnight and dawn and none during daylight hours.

The amount of rainfall, which is directly related to river flow, is probably the most significant factor influencing the intensity of migration. The precipitation and the catch per net day is given in Table 4 and the graphical illustration is shown in Figure 7. The environmental conditions for August - October are presented in Appendix C.

The phase of the moon may also play a role in migration, however, data were only collected for one lunar cycle, thus it is difficult to assess its overall effect. The patterns observed would indicated that the migration of "silver" eels is most likely to coincide with heavy rainfall during the time of a full moon.

Note: A net day is regarded as one standard fyke net fishing for 24 hours.

Table 4: Relationship of rainfall to daily catches of eels.

Date	Precipitation (mm)	Lbs. Per Net Day	Date	Precipitation (mm)	Lbs. Per Net Day
Aug. 16	-	8.8	Sept. 11	1.0	84.5
17	-	8.5	12	-	38.5
18	-	9.8	13	-	48.4
19	-	4.0	14	-	46.7
20	-	5.8	15	12.6	64.77
21	2.6	9.3	16	1.0	88.9
22	.4	5.0	17	7.2	37.6
23	-	10.0	18	.4	49.2
24	.4	7.7	19	6.4	53.8
25	3.0	8.0	20	-	40.8
26	3.4	5.2	21	7.6	43.4
27	.6	4.5	22	-	27.5
28	2.4	6.4	23	-	17.9
29	-	4.7	24	3.2	38.5
30	-	3.1	25	-	16.6
31	.4	12.1	26	-	14.3
Sept. 1	1.4	6.4	27	-	-
2	8.0	8.3	28	10.0	-
3	23.8	11.0	29	-	18.0
4	1.6	21.9	30	1.6	40.0
5	-	15.6	Oct. 1	15.2	49.0
6	-	27.1	2	40.4	335.0
7	14.4	64.8	3	2.8	No Fishing Due to Floods
8	-	66.1			
9	.6	54.0			
10	4.8	82.2			

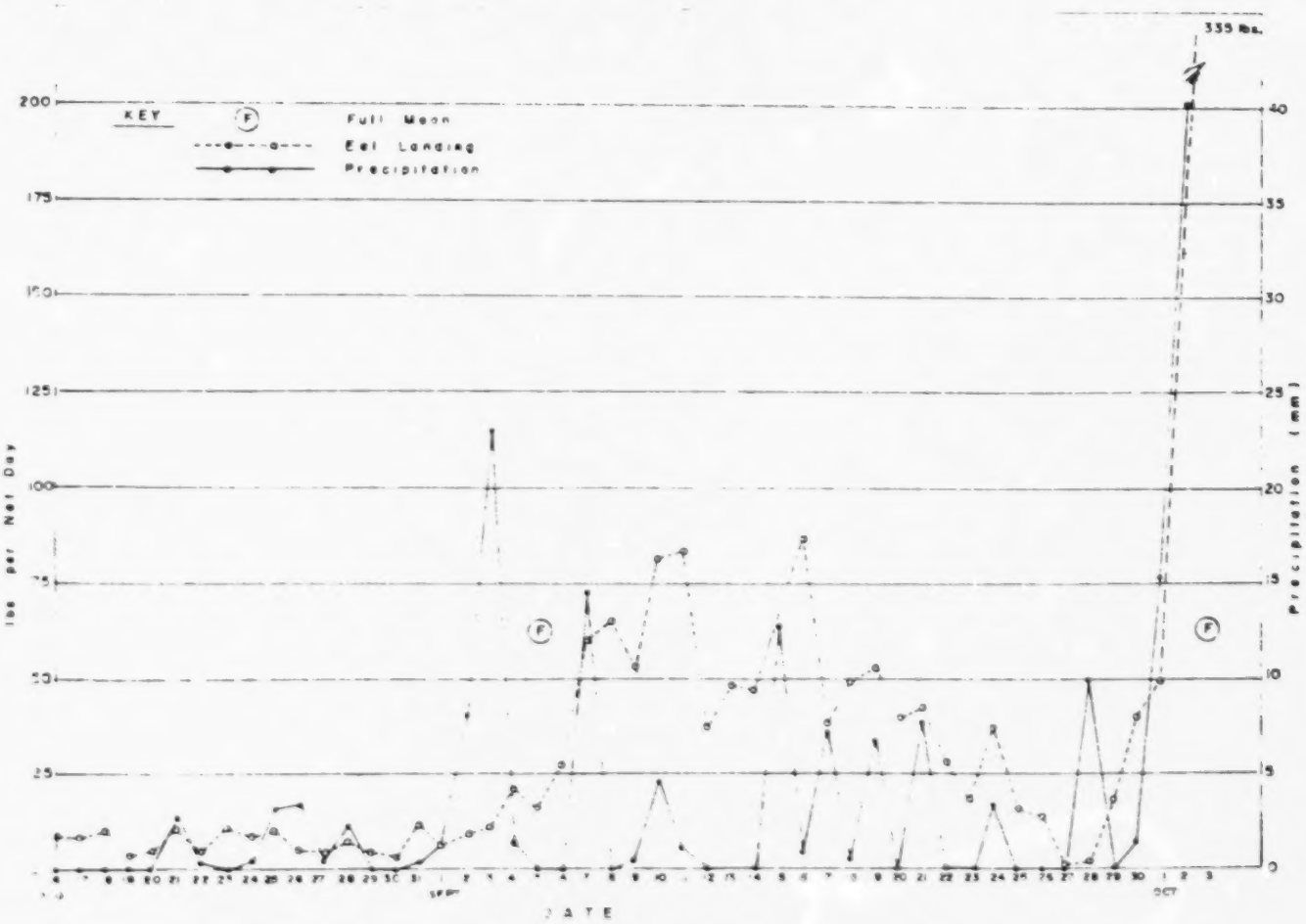

Figure 7: Relationship of Catch Per Unit Effort to Precipitation.

PRODUCT DEVELOPMENT POTENTIAL

The Newfoundland eel fishery is based on the export of live or fresh frozen eels to European markets for secondary processing. In order to maximize the economic gains from the eel fishery it is essential to develop a form of secondary processing which would increase the monetary returns from the fishery.

A local eel buyer has the facilities to produce a smoked product; however, the process of smoking eels for European markets is a highly technical art which varies depending upon local preferences. If this problem can be overcome by experimental processing and marketing in Europe and North America, it would be possible to produce a finished product from this under-utilized resource.

RECOMMENDATIONS

1. In accordance with the long-term management of the fishery, it is recommended that future development be directed towards the "silver eel" fishery.

2. The present system of licencing should be reviewed by the Provincial Department of Fisheries and the Department of Fisheries and Oceans. The issuing of licences should be limited to one or two fishermen per river system depending upon the resources.

3. In order to fish during flood periods in the fall it is essential that weirs which are not presently used be developed for large rivers. It is recommended that the Department construct a weir on a large river of this type to determine gear feasibility and if successful to act as a model for fishermen interested in fishing other rivers by this method.

4. Small unsized eels created problems in marketing during 1982. A size standard as determined by the marketability of the eel should be enforced and eels smaller than these limits should be released.

5. It is recommended that all possible forms of secondary processing, particularly smoked eels, be explored to assure that the Province receives a maximum return from the resource.

6. Further expansion into new areas of the Province is recommended to determine the resource and assist in establishing a commercial eel fishery in these areas.

ACKNOWLEDGEMENTS

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All the fishermen listed in Table 2 of the text for for information they provided.

Eel buyers: Mr. Eric Oram, Mr. Sandy White, Mr. Jim Moore for providing records of eel purchases.

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Special thanks to Mr. Olindo Hodder for assistance and advise on the design and use of eel fishing equipment.

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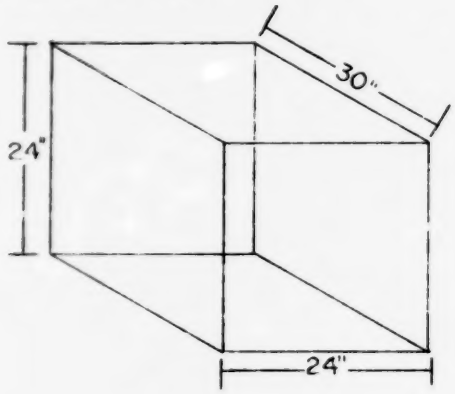
APPENDIX A

HOW TO BUILD AN EEL FYKE NET

How To Build An Eel Tyke Net:

Materials needed:

1) Wings - 1½" mesh
2) Bag 3/4" - 7/8" mesh
3) Stakes - Usually sturdy tree branches
4) 3/8" metal bar (i.e. rebar) (26 feet for a 2' X 2.5' frame)
5) Frame Funnel made from 1 1/8" or 1¼" mesh
6) 3/8" head rope
7) leaded foot rope
8) #18 heading twine for sewing



This drawing shows the metal frame (3/8") required to make net sturdy and stable. Actually dimensions depend on size of net but a popular size is 2' X 2' X 2.5'.

Eel fyke nets with the square or rectangular metal frame are popular because they are sturdy and stable in the water. Nets with a round frame or round hoops tend to roll around in the water and can get tangled.

All materials listed above are just examples of what can be used to construct a fyke net.

Nets should be set well enough that it can take the force of increased water flow such as after a rain when water levels rise. Nets are often lost (washed away) because fishermen do not set the nets securely enough. Fastening one wing securely to a nearby tree or rock may

prevent your net from being washed away. A mesh size of 3/4" in the bag will allow water to flow through the net and prevent the escape of eels.

The bag should also be sewn together well enough to be able to withstand the pressure exerted by several hundred pounds of writhing eels. The stronger the current the more stakes and support needed. Rocks should be placed along the bottom of the net and much care should be taken to make sure there are no holes or places where the eels may escape under the net.

The V-shape of the wings should not be too wide and the net should be set in such a way that water is moving quickly into the opening of the net (bag). When the eels do begin running the nets will have to be checked every 2 or 3 hours from dusk to about midnight - the bag may have to be emptied several times if the run is a large one.

Wing length and bag length varies but a wing length of 15-18' per wing and a bag length of 15-20 feet would make a good sized net.

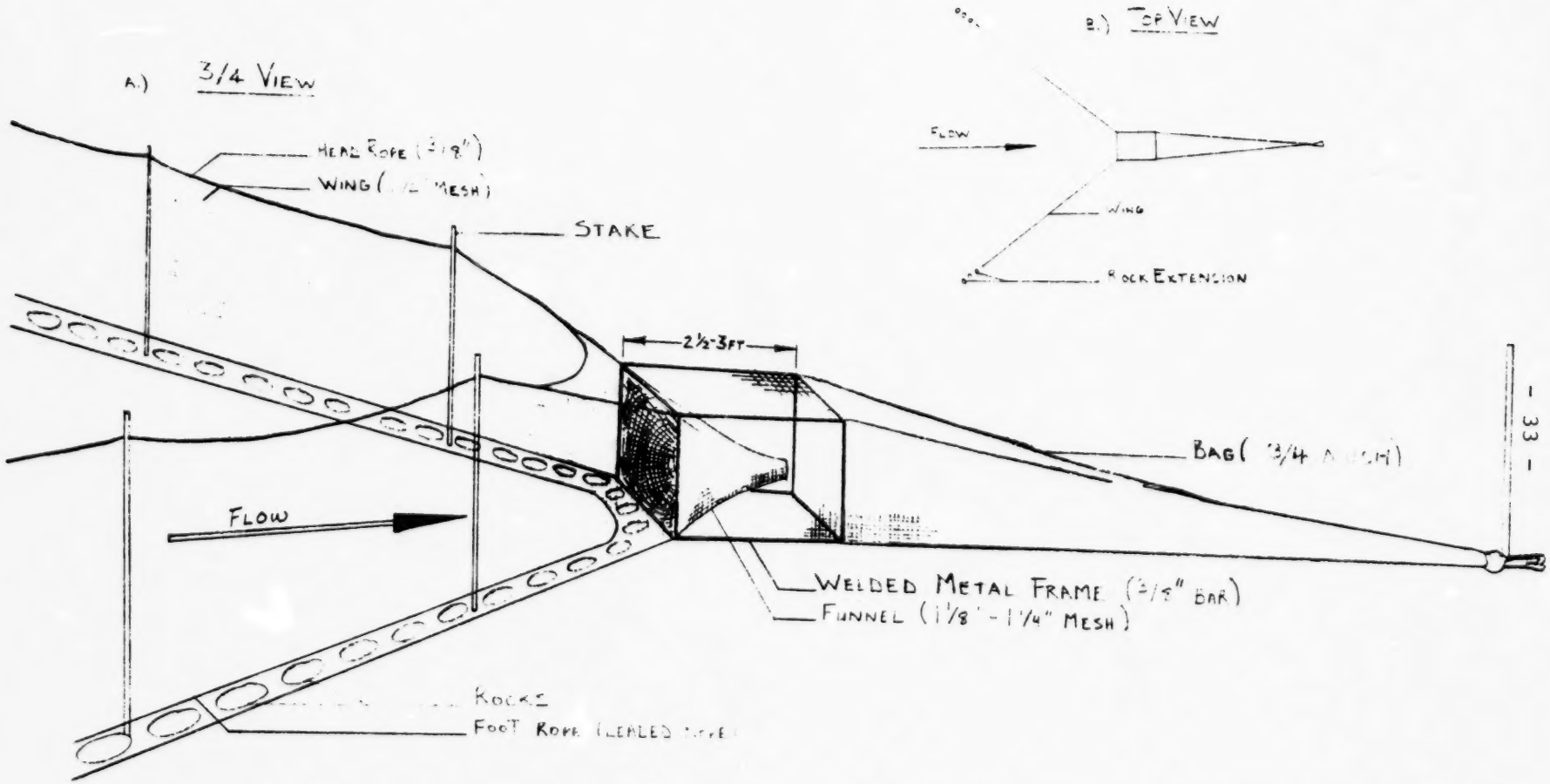


Figure 8 . Diagrams showing a) a"three-quarter" view of an eel fyke net with welded metal frame and b) top view of same net showing flow direction and approximate wing angles. Rock extensions can be used to lengthen wings. This net is ideal for slow to moderate flow streams or rivers. From Bouillon, D., 1981 - Unpublished.

APPENDIX B

HOW TO BUILD AN EEL HOLDING PEN

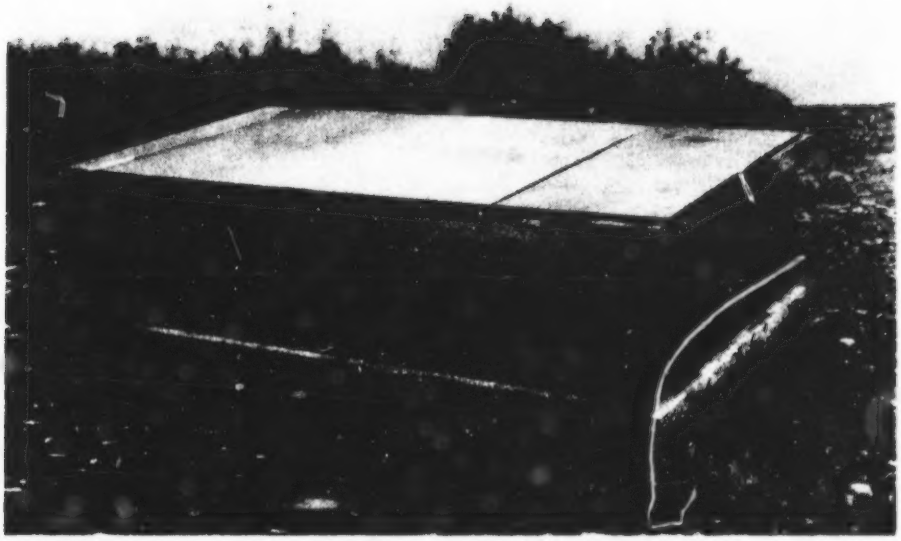
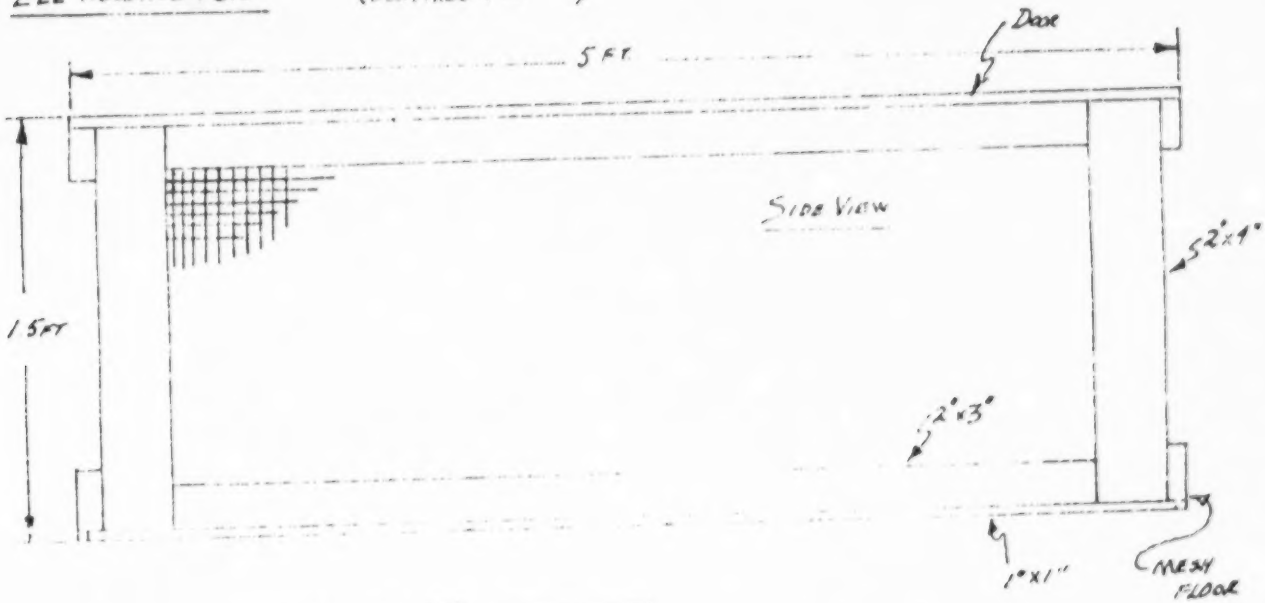


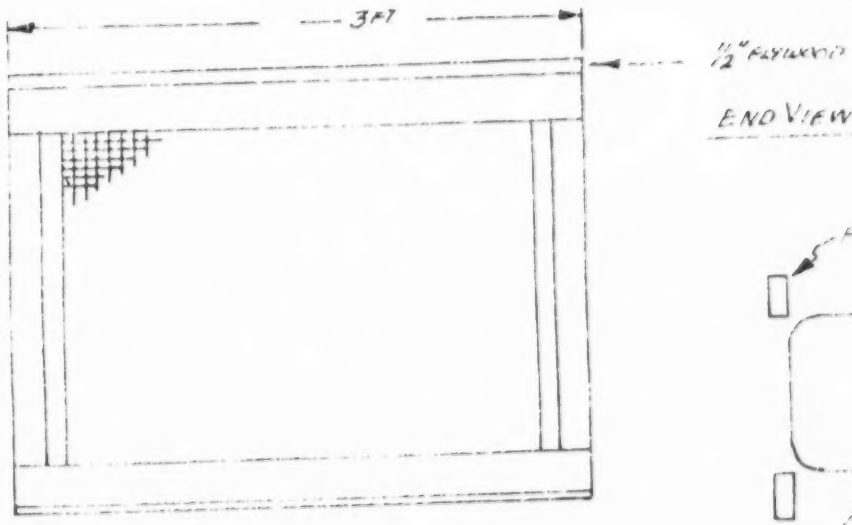
Figure 11: An ideal sized eel holding pen* that is sturdy and easy to build. Yellow eels must be held in the water without food for at least 7 days prior to shipping to allow their intestines to clear and thus prevent build up of coliform bacteria.

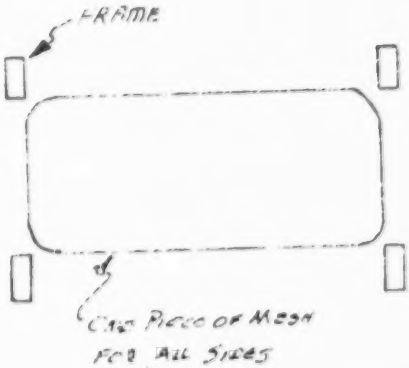
If the eels are to be held for a short period of time it is possible to use net bags of 3/4" mesh. However for holding eels for prolonged periods of time a holding bin is recommended.

* See diagrams following page.

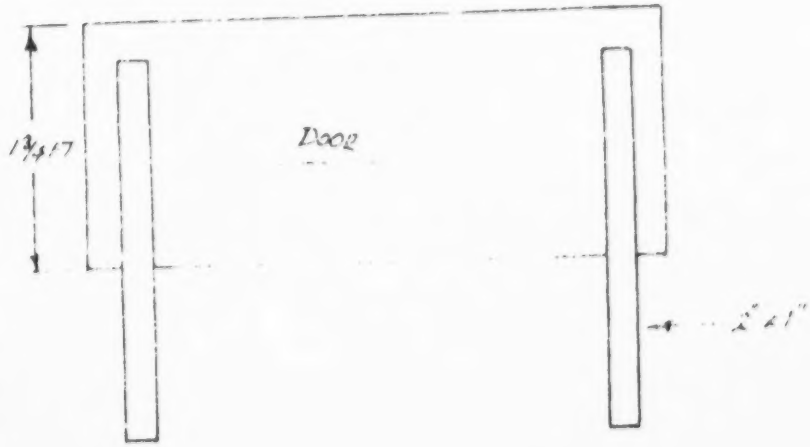
EEL HOLDING PEN (SEE ALSO FIG)







MESH 1/2" x 1/2" GALVANIZED MESH



APPENDIX C

Meteorological Information

August - October 1982

Environment Canada / Environnement Canada
Atmospheric Environment / Environnement atmosphérique

MONTHLY METEOROLOGICAL SUMMARY
SOMMAIRE MÉTÉOROLOGIQUE MENSUEL

MONTH/MOIS AUGUST/AOUT 19 82

AT/A GANDER INTERNATIONAL AIRPORT, NEWFOUNDLAND

LAT 48° 57' N LONG 54° 34' W ELEVATION/ALTITUDE 148.9 METRES (ASL) METRES (MMM) STANDARD TIME USED/HEURE NORMALE UTILISEE NST

DATE	TEMPERATURE/TEMPERATURE MAXIMUM MAXIMALE	MINIMUM MINIMALE	MEAN MOYENNE	DEGREE DAYS/DEGRES-JOURS HEATING/DE CHAUFFE base 18°C	COOLING/DE CROISSANCE base 18°C	REL HUMIDITY/HUMIDITE REL MAXIMUM MAXIMALE	MINIMUM MINIMALE	THUNDERSTORM/ORAGE	PRECIPITATION/PRECIPITATIONS RAINFALL/PLUIE (HAUTEUR) mm	SNOWFALL/NEIGE (HAUTEUR) cm	TOTAL PRECIP/PRECIP TOTALE mm	SNOW ON GROUND/NEIGE AU SOL cm	WIND/VENT AVERAGE SPEED/VITESSE MOYENNE km/h	PREVAILING DIRECTION/DIRECTION DOMINANTE	MAXIMUM SPEED AND DIRECTION/VITESSE MAXIMALE ET DIRECTION km/h	BRIGHT SUNSHINE/INSOLATION EFFECTIVE HOURS/HEURES
1	26.1	13.6	20.0	-	15.0	82	39		-		-		15.8	WSW	30WSW*	13.6
2	22.6	8.8	15.7	2.3	10.7	82	38		-		-		26.9	SW	37SW	10.4
3	17.9	8.0	13.0	5.0	8.0	82	42		-		-		16.5	WSW	26W*	7.1
4	18.8	7.2	13.0	5.0	8.0	76	34		-		-		20.0	W	28WNW*	14.3
5	17.6	7.6	12.6	5.4	7.6	82	39		-		-		17.2	W	22W*	11.3
6	18.5	8.6	13.6	4.4	8.6	82	39		TR		TR		11.5	SW	24SW	9.2
7	21.3	9.8	15.6	2.4	10.6	87	35		TR		TR		15.8	W	24S	9.2
8	17.8	9.8	13.8	4.2	8.8	94	52		2.2		2.2		13.9	WSW	24SW*	3.9
9	20.5	9.0	14.8	3.2	9.8	93	46		-		-		9.1	SVRL	15WSW	7.7
10	20.1	12.0	16.1	1.9	11.1	94	56		6.4		6.4		23.6	SVRL	30SW*	4.5
11	24.0	15.2	19.6	-	14.6	88	54		-		-		17.5	WSW	30SSW*	4.6
12	23.2	13.0	18.1	-	13.1	82	44		-		-		20.5	W	35W	12.7
13	26.2	12.6	19.4	-	14.4	94	37		1.6		1.6		11.9	W	22W	11.2
14	22.6	15.5	19.1	-	14.1	94	78		14.8		14.8		16.1	SW	33SW	0.6
15	23.1	14.0	18.6	-	13.6	94	50		-		-		15.7	SW	24SW*	5.2
16	22.5	13.6	18.1	-	13.1	82	50		-		-		17.6	W	26WSW	11.0
17	27.5	15.4	21.5	-	16.5	82	44		-		-		25.1	WSW	37SW	13.5
18	23.1	11.8	17.5	0.5	12.5	83	42		-		-		24.0	SW	37SW*	7.1
19	21.8	10.7	16.3	1.7	11.3	88	40		TR		TR		10.8	WSW	26W	8.0
20	22.0	11.6	16.8	1.2	11.8	88	53		-		-		24.6	SSW	37SW*	9.3
21	19.6	8.2	13.9	4.1	8.9	94	48		2.6		2.6		17.9	W	30SSW	4.5
22	18.8	7.4	13.1	4.9	8.1	87	42		0.4		0.4		17.5	W	22WSW	8.7
23	18.8	8.2	13.5	4.5	8.5	87	48		TR		TR		17.5	WSW	28WSW	8.8
24	19.9	10.5	15.2	2.8	10.2	88	49		0.4		0.4		16.2	S	28S	11.1
25	20.8	11.4	15.7	2.3	10.7	94	68		3.0		3.0		16.0	W	26S	5.5
26	18.0	10.8	13.4	4.6	8.4	94	87		3.4		3.4		16.0	ESE	30ESE	0.0
27	19.7	10.4	15.1	2.9	10.1	94	40		0.6		0.6		27.5	W	41NW*	9.6
28	21.2	7.1	14.2	3.8	9.2	83	54		2.4		2.4		25.5	SSW	48SW	5.3
29	15.3	5.2	10.3	7.7	5.3	87	41		-		-		16.6	WSW	28W	7.7
30	17.8	6.1	12.0	6.0	7.0	81	42		-		-		16.0	W	28W	11.6
31	18.2	7.1	12.7	5.3	7.7	87	42		0.4		0.4		21.3	S	33SSW	9.5
MEAN MOYENNE	20.7	10.3	15.5	TOTAL 86.1	TOTAL 327.3	87.3	47.5	TOTAL	TOTAL 38.2	TOTAL	TOTAL 38.2		18.1	PREVAILING W DOMINANTE	MAXIMUM 48SW	TOTAL 256.7
NORMAL NORMALE	20.3	10.8	15.6	91.5	328.2			2.2	97.3		97.3		18.2	SW		180.5

DEGREE DAY SUMMARY - SOMMAIRE DE DEGRÉS-JOURS

BELOW 18°C / AU-DESSOUS DE 18°C	THIS YEAR / ANNÉE EN COURS	PREVIOUS YEAR / ANNÉE PRÉCÉDENTE	NORMAL / NORMALE	ABOVE 5°C / AU DESSUS DE 5°C	THIS YEAR / ANNÉE EN COURS	PREVIOUS YEAR / ANNÉE PRÉCÉDENTE	NORMAL / NORMALE
TOTAL FOR MONTH / TOTAL DU MOIS	86.1	95.3	91.5	TOTAL FOR MONTH / TOTAL DU MOIS	327.3	325.3	328.2
ACCUMULATED SINCE JULY 1 / ACCUMULÉE DEPUIS LE 1er JUILLET	158.3	182.2	163.7	ACCUMULATED SINCE APRIL 1 / ACCUMULÉE DEPUIS LE 1er AVRIL	848.8	936.8	969.2

DAYS WITH TOTAL PRECIPITATION / JOURS AVEC PRÉCIPITATIONS TOTALES (mm)

0.2 OR MORE / OU PLUS	1.0 OR MORE / OU PLUS	2.0 OR MORE / OU PLUS	10.0 OR MORE / OU PLUS	50.0 OR MORE / OU PLUS
12	8	7	1	0

DAYS WITH SNOWFALL / JOURS AVEC CHUTE DE NEIGE (cm)

0.2 OR MORE / OU PLUS	1.0 OR MORE / OU PLUS	2.0 OR MORE / OU PLUS	10.0 OR MORE / OU PLUS	50.0 OR MORE / OU PLUS
0	0	0	0	0

UDE 5515061 E

*Indicates occurrences of same speed but not necessarily in the same direction.

Subscription Price $1.00 monthly, $10.00 per calendar year (January to December)
Prix d'abonnement: mensuel $1.00, annuel $10.00 (janvier à décembre)

Environment Canada / Environnement Canada

Atmospheric Environment / Environnement atmosphérique

MONTHLY METEOROLOGICAL SUMMARY
SOMMAIRE MÉTÉOROLOGIQUE MENSUEL

MONTH/MOIS SEPTEMBER/SEPTEMBRE 1982

AT/À GANDER INTERNATIONAL AIRPORT, NEWFOUNDLAND

LAT 48 57 N LONG 54 34 W ELEVATION/ALTITUDE 146.9 METRES (ASL) / METRES (NMM) STANDARD TIME USED / HEURE NORMALE UTILISÉE NST

DAY	TEMPERATURE / TEMPÉRATURE: MAXIMUM MAXIMALE	MINIMUM MINIMALE	MEAN MOYENNE	DEGREE DAYS / DEGRÉS JOURS: HEATING / DE CHAUFFE (BASE 18°C)	GROWING / DE CROISSANCE (BASE 5°C)	REL HUMIDITY / HUMIDITÉ REL: MAXIMUM MAXIMALE	MINIMUM MINIMALE	THUNDERSTORM / ORAGE	PRECIPITATION / PRÉCIPITATIONS: RAINFALL / PLUIE (HAUTEUR)	SNOWFALL / NEIGE (HAUTEUR)	TOTAL PRECIP / PRÉCIP TOTALE	SNOW ON GROUND / NEIGE AU SOL	WIND / VENT: AVERAGE SPEED / VITESSE MOYENNE	PREVAILING DIRECTION / DIRECTION DOMINANTE	MAXIMUM SPEED AND DIRECTION / VITESSE MAXIMALE ET DIRECTION	BRIGHT SUNSHINE / INSOLATION EFFECTIVE
	°C	°C	°C			%	%		mm	cm	mm	cm	km/h		km/h	HOURS / HEURES
1	17.8	8.4	13.1	4.9	8.1	88	55	1	1.4		1.4		21.3	SVRL	33S	6.7
2	12.2	7.7	10.2	7.8	5.2	93	67		8.0		8.0		13.0	ESE	22ESE	0.0
3	18.2	9.0	13.6	4.4	8.6	100	88		23.8		23.8		23.2	ESE	31ESE	0.0
4	21.9	13.6	17.8	0.2	12.8	94	68		1.6		1.6		23.7	SW	35SW	3.2
5	19.6	11.0	15.3	2.7	10.3	88	45		-		-		18.6	W	30W	11.4
6	22.8	10.4	16.6	1.4	11.6	88	53		-		-		18.1	SVRL	28SSW*	7.4
7	14.4	3.8	9.1	8.9	4.1	94	71		14.4		14.4		21.3	N	50N	0.2
8	12.7	7.8	7.8	10.2	2.8	93	38		-		-		14.6	NNW	36WNW	9.4
9	14.7	5.6	9.7	8.3	4.7	87	54		0.6		0.6		19.7	SW	28SW	6.2
10	17.4	9.6	13.5	4.5	8.5	94	68		4.8		4.8		25.0	WSW	43WSW	1.3
11	11.8	7.4	9.6	8.4	4.6	94	71		1.0		1.0		20.8	NNW	32NNW	1.2
12	14.6	6.0	10.3	7.7	5.3	93	55		-		-		21.8	W	41W	9.5
13	25.4	7.7	16.5	1.5	11.5	87	47		-		-		23.7	W	33W	8.9
14	27.7	15.3	21.3	-	16.3	82	51		-		-		27.6	WSW	33W*	9.8
15	16.2	5.5	10.9	7.1	5.9	93	82		12.6		12.6		18.9	ENE	26WSW*	0.0
16	12.1	3.3	7.7	10.3	2.7	93	40		1.0		1.0		16.6	E	26ESE	10.2
17	15.5	7.9	11.7	6.3	6.7	100	87		7.2		7.2		19.5	ESE	33ESE	0.0
18	12.1	9.1	10.6	7.4	5.6	100	82		0.4		0.4		16.5	E	26E	0.0
19	14.0	8.4	11.2	6.8	6.2	100	76		6.4		6.4		19.4	WSW	26WSW	0.3
20	16.8	7.1	12.0	6.0	7.0	87	48		-		-		24.1	SVRL	33WSW	10.0
21	11.3	6.3	8.8	9.2	3.8	93	66		7.6		7.6		11.8	WSW	22WSW*	0.0
22	16.8	7.1	12.0	6.0	7.0	93	48		-		-		14.6	W	24W	7.7
23	18.6	9.5	14.1	3.9	9.1	87	42		-		-		11.6	SVRL	22SSE	9.2
24	19.9	10.6	15.3	2.7	10.3	94	52		3.2		3.2		12.0	SSE	52WSW	4.6
25	13.8	6.5	10.2	7.8	5.2	93	71		-		-		19.5	W	30WSW*	2.1
26	18.0	7.9	13.0	5.0	8.0	93	44		-		-		17.8	W	30W*	9.4
27	20.1	7.9	14.0	4.0	9.0	87	52		-		-		14.8	WSW	30W	6.6
28	12.8	2.3	7.6	10.4	2.6	94	76		10.0		10.0		17.9	WSW	42N*	0.0
29	9.5	-0.4	4.6	13.4	-	80	43		-		-		25.2	WNW	41WNW*	8.7
30	8.2	0.7	4.5	13.5	-	93	39		1.6		1.6		24.0	WNW	33NW	6.8
31																
MEAN / MOYENNE	16.2	7.3	11.8	TOTAL 190.7	TOTAL 203.5	91.8	59.3	TOTAL 1	TOTAL 105.6	TOTAL	TOTAL 105.6		19.9	PREVAILING SVRL DOMINANTE	MAXIMUM 52WSW	TOTAL 150.8
NORMAL / NORMALE	15.9	6.9	11.4	200.0	192.3			0.3	81.1		81.1		21.2	SW		145.3

DEGREE DAY SUMMARY - SOMMAIRE DE DEGRÉS-JOURS

BELOW 18°C / AU DESSOUS DE 18°C	THIS YEAR / ANNÉE EN COURS	PREVIOUS YEAR / ANNÉE PRÉCÉDENTE	NORMAL / NORMALE	ABOVE 5°C / AU DESSUS DE 5°C	THIS YEAR / ANNÉE EN COURS	PREVIOUS YEAR / ANNÉE PRÉCÉDENTE	NORMAL / NORMALE
TOTAL FOR MONTH / TOTAL DU MOIS	190.7	180.3	200.0	TOTAL FOR MONTH / TOTAL DU MOIS	203.5	209.9	192.3
ACCUMULATED SINCE JULY 1 / ACCUMULÉE DEPUIS LE 1er JUILLET	349.0	362.5	363.7	ACCUMULATED SINCE APRIL 1 / ACCUMULÉE DEPUIS LE 1er AVRIL	1052.3	1146.7	1161.5

DAYS WITH TOTAL PRECIPITATION / JOURS AVEC PRÉCIPITATIONS TOTALES (mm)

0.2 OR MORE / OU PLUS	1.0 OR MORE / OU PLUS	2.0 OR MORE / OU PLUS	10.0 OR MORE / OU PLUS	50.0 OR MORE / OU PLUS
17	15	10	4	-

DAYS WITH SNOWFALL / JOURS AVEC CHUTE DE NEIGE (cm)

0.2 OR MORE / OU PLUS	1.0 OR MORE / OU PLUS	2.0 OR MORE / OU PLUS	10.0 OR MORE / OU PLUS	50.0 OR MORE / OU PLUS
-	-	-	-	-

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Prix d'abonnement: mensuel $1.00, annuel $10.00 (janvier à décembre)

Environment Canada / Environnement Canada
Atmospheric Environment / Environnement atmosphérique

MONTHLY METEOROLOGICAL SUMMARY
SOMMAIRE MÉTÉOROLOGIQUE MENSUEL

MONTH/MOIS OCTOBER/OCTOBRE 19 8.

AT/A GANDER INTERNATIONAL AIRPORT, NEWFOUNDLAND

LAT 48 57 N LONG 54- 34 W ELEVATION ALTITUDE 146.9 METRES (ASL) MÈTRES (NMM) STANDARD TIME USED HEURE NORMALE UTILISÉE NST

DATE	TEMPERATURE TEMPERATURE MAXIMUM MAXIMALE (°C)	MINIMUM MINIMALE (°C)	MEAN MOYENNE (°C)	DEGREE-DAYS DEGRÉS-JOURS HEATING DE CHAUFFE (base 18°C)	GROWING DE CROISSANCE (base 5°C)	REL HUMIDITY HUMIDITÉ REL MAXIMUM MAXIMALE (%)	MINIMUM MINIMALE (%)	THUNDERSTORM ORAGE	PRECIPITATION PRÉCIPITATIONS RAINFALL PLUIE (HAUTEUR) (mm)	SNOWFALL NEIGE (HAUTEUR) (cm)	TOTAL PRECIP. PRÉCIP. TOTALE (mm)	SNOW ON GROUND NEIGE AU SOL (cm)	WIND VENT AVERAGE SPEED VITESSE MOYENNE (km/h)	PREVAILING DIRECTION DIRECTION DOMINANTE	MAXIMUM SPEED AND DIRECTION VITESSE MAXIMALE ET DIRECTION (km/h)	BRIGHT SUNSHINE INSOLATION EFFECTIVE (HOURS HEURES)
1	14.6	5.3	10.0	8.0	5.0	94	82		15.2	-	15.2		19.0	WSW	32WSW	0.1
2	7.3	3.9	5.6	12.4	0.6	93	87		40.4	-	40.4		34.8	NE	44ENE	0.0
3	6.8	3.5	5.2	12.8	0.2	93	65		3.8	-	3.8		29.2	NNE	33NNE*	1.8
4	6.3	3.7	5.0	13.0	-	93	81		23.2	-	23.2		32.0	NNW	41NNW	0.0
5	9.2	2.5	5.9	12.1	0.9	87	46		0.8	-	0.8		30.1	NW	43NW*	7.2
6	11.5	2.5	7.0	11.0	2.0	93	57		3.0	-	3.0		19.0	W	28W	4.4
7	5.3	-0.4	2.5	15.5	-	93	69		1.4	1.4	2.8		19.4	NNE	37NW*	4.3
8	2.8	-1.0	0.9	17.1	-	86	60		-	2.6	2.4		20.0	WNW	33NNW	2.3
9	3.6	-1.3	1.2	16.8	-	93	69		2.4	3.8	6.6		24.7	WNW	41N	0.9
10	2.9	-0.5	1.2	16.8	-	93	80		3.2	1.8	5.0		27.6	NNW	33NNW*	3.2
11	4.4	1.0	2.7	15.3	-	93	70		0.4	-	0.4		18.8	N	28N*	1.5
12	9.6	-0.2	4.7	13.3	-	93	61		0.2	-	0.2		8.5	S	19SSE*	7.0
13	7.4	0.0	3.7	14.3	-	93	75		0.4	-	0.4		13.8	NE	24NE	2.2
14	5.4	2.5	4.0	14.0	-	87	65		TR	-	TR		15.0	NE	26NE	0.0
15	7.7	2.6	5.2	12.8	0.2	93	75		9.8	TR	9.8		34.8	ESE	56ESE*	0.0
16	14.3	3.5	8.9	9.1	3.9	93	62		8.2	-	8.2		19.9	WSW	32W	4.4
17	11.9	4.0	8.0	10.0	3.0	94	66		1.0	-	1.0		26.5	WSW	41W*	5.3
18	8.7	1.0	4.9	13.1	-	81	49		-	-	-		22.9	W	30WNW*	7.8
19	11.2	1.2	6.2	11.8	1.2	80	50		TR	-	TR		21.4	WSW	32WSW	6.9
20	14.7	7.0	10.9	7.1	5.9	87	51		-	-	-		24.6	WSW	33WSW*	5.9
21	18.3	8.1	13.2	4.8	8.2	88	59		TR	-	TR		32.4	WSW	46SW	7.0
22	12.9	-2.9	5.0	13.0	-	88	63		2.8	0.4	3.4		23.0	NNW	33WNW	1.7
23	1.3	-2.5	-0.6	18.6	-	69	47		-	-	-		18.0	WNW	26WNW*	3.3
24	0.0	-4.0	-2.0	20.0	-	80	47		-	TR	TR	TR	21.6	W	33NW	2.3
25	9.7	-4.0	2.9	15.1	-	75	43		TR	-	TR		36.2	WSW	48WSW	6.9
26	5.6	-4.2	0.7	17.3	-	87	41		1.2	0.2	1.6		23.7	NNW	37NNW	7.2
27	7.7	-4.0	1.9	16.1	-	74	41		-	-	-		15.1	W	26W	7.7
28	2.1	-1.9	0.1	17.9	-	93	74		-	1.6	2.2		10.6	S	28NNW*	0.0
29	-1.0	-2.7	-1.9	19.9	-	86	63		-	TR	TR	TR	18.2	NNW	28WNW	0.0
30	4.2	-2.0	1.1	16.9	-	87	51		0.6	-	0.6	TR	11.9	SW	22SW*	5.3
31	10.0	3.9	7.0	11.0	2.0	93	76		TR	-	TR		25.8	SSW	33SW*	0.1
MEAN MOYENNE	7.6	0.8	4.2	TOTAL 426.9	TOTAL 33.1	88.1	62.1	TOTAL	TOTAL 118.0	TOTAL 11.8	TOTAL 131.0		22.5	PREVAILING WSW DOMINANTE	MAX 56ESE*	TOTAL 106.7
NORMAL NORMALE	9.8	2.2	6.0	371.6	63.2			0.2	91.3	12.2	104.7		22.0	SW		111.8

DEGREE DAY SUMMARY - SOMMAIRE DE DEGRÉS-JOURS

BELOW 18°C AU-DESSOUS DE 18°C	THIS YEAR ANNÉE EN COURS	PREVIOUS YEAR ANNÉE PRÉCÉDENTE	NORMAL NORMALE	ABOVE 5°C AU DESSUS DE 5°C	THIS YEAR ANNÉE EN COURS	PREVIOUS YEAR ANNÉE PRÉCÉDENTE	NORMAL NORMALE
TOTAL FOR MONTH TOTAL DU MOIS	426.9	343.8	371.6	TOTAL FOR MONTH TOTAL DU MOIS	33.1	84.5	63.2
ACCUMULATED SINCE JULY 1 ACCUMULÉE DEPUIS LE 1er JUILLET	775.9	706.3	735.3	ACCUMULATED SINCE APRIL 1 ACCUMULÉE DEPUIS LE 1er AVRIL	1085.4	1231.2	1224.7

DAYS WITH TOTAL PRECIPITATION JOURS AVEC PRÉCIPITATIONS TOTALES (mm)

0.2 OR MORE OU PLUS	1.0 OR MORE OU PLUS	2.0 OR MORE OU PLUS	10.0 OR MORE OU PLUS	50.0 OR MORE OU PLUS
20	15	13	3	0

DAYS WITH SNOWFALL JOURS AVEC CHUTE DE NEIGE (cm)

0.2 OR MORE OU PLUS	1.0 OR MORE OU PLUS	2.0 OR MORE OU PLUS	10.0 OR MORE OU PLUS	50.0 OR MORE OU PLUS
7	5	2	0	0

UDC 551.506.1

*Indicates occurrences of same speed but not necessarily in the same direction.

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QUALITY

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